APPENDIX G -- RESULTS FROM A PRELIMINARY SOIL SALINITY SAMPLING EVENT ALONG THE NORTHWEST FORK OF THE LOXAHATCHEE RIVER

CONTENTS

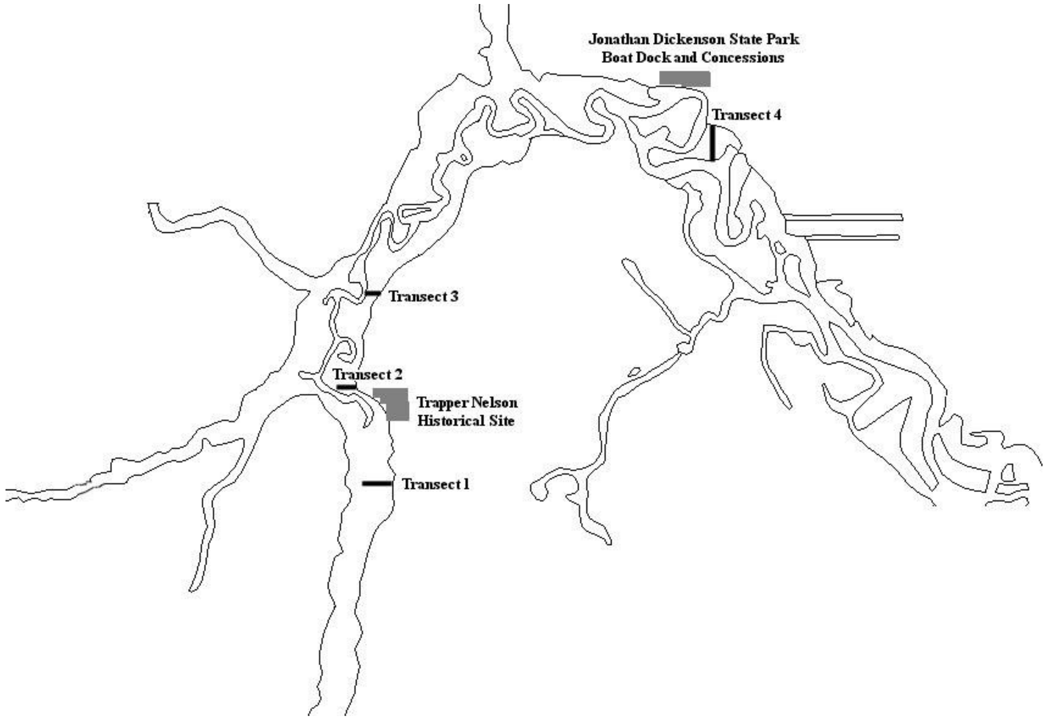
INTRODUCTION

A preliminary study of soil salinity was conducted along the Northwest Fork of the Loxahatchee River in January 2002 at four sites that represent different surface water (river) salinity conditions. This sampling effort was initiated to better understand the correlation between plant community composition and soil salinity levels, and to serve as a reconnaissance effort to gain information useful for the design of future sampling projects. The results of this study will be used to document a soil salinity gradient along the River corridor and determine if, and how, soil salinity levels vary with increasing distance from the Jupiter Inlet and soil depth.

Soil Salinity Sampling

Four soil sampling transects were established along the NW Fork of the Loxahatchee River at locations that represent varying degrees of exposure to elevated salinity from tidal influx (**Figure G-1**). All transects crossed the river floodplain, extending from the shoreline to the floodplain/upland ecotone. Transect 1 lies in an area of the NW Fork that has not been influenced by tidal salinity and crosses a freshwater floodplain swamp community dominated by swamp hardwoods (e.g. laurel oak, red bay, red maple, swamp hickory) and bald cypress. Transect 4 is located south of the Jonathan Dickinson State Park's concessions/parking area (near river mile 7.0) along a segment of the River that has been highly impacted by tidal inflows. Freshwater seeps originating from upland groundwater sources support remnant swamp hardwoods (e.g. pop ash, pond apple) and bald cypress at the floodplain/upland ecotone. Elsewhere within the floodplain, white and red mangrove dominate. Transects 2 is located just north of the Trapper Nelson homestead (near river mile 10.5) and crosses a freshwater floodplain swamp community that has been only occasionally impacted by elevated salinity. Transect 3 was located near river mile 9.9, where much of the local freshwater floodplain swamp is intact but some red mangrove (a saltwater species) is found (see **Appendix C**, Vegetation Survey Data). The selection of these sites was intended to 1) coincide with earlier vegetation transect surveys conducted by staff at Jonathan Dickinson State Park; 2) represent a gradient of sites that span from wholly freshwater to mostly saltwater conditions; and 3) represent a gradient of vegetation communities spanning from pristine freshwater swamp forest to mangrove-dominated swamp.

Figure G-1. Location of Soil Sampling Transects along the NW Fork of the Loxahatchee River, as Indicated by Black Lines



Soil sampling plot information is shown in **Table G-1**. Our original sampling design included the installation of temporary PVC wells to collect pore water samples from three depths (10 cm, 20 cm and 50 cm below the soil surface) within each plot and to analyze the samples for conductivity, chloride and sodium. In the field, we discovered that the soil conditions would not allow collection of enough pore water for the laboratory analyses. Instead, grab samples from the upper one-foot of soil were collected from all of the plots in Transects 1, 2, and 3. At transect 1, an additional sample from the flowing channel of the river was collected. At transect 3, only three plots were able to be collected due to the large amount of non-native Old World Climbing Fern (*Ligodium microphyllum*) that covered the more upland side of the transect. At transect 4, which is the most saltwater impacted site, additional samples were collected with a soil corer to include depths of 1-2' and 2-3' increments. Sufficient amounts of soil were collected from all of the plots to provide enough water for conductivity and chloride analysis.

Table G-1. Location of Soil Sampling Plots within Transects along the NW Fork of the Loxahatchee River

Collection Date	Transect	Plot (distance from River channel)
01-22-02	1	River bed
01-23-02	1	River bottom
01-23-02	2	0-3 meters
01-23-02	2	3-13 meters
01-23-02	2	33-43 meters
01-23-02	2	63-73 meters
01-23-02	2	93-103 meters
01-24-02	3	0-10 meters
01-24-02	3	30-40 meters
01-24-02	3	64-74 meters
01-24-02	4	0-10 meters
01-24-02	4	45-55 meters
01-24-02	4	95-105 meters
01-24-02	4	155-165 meters

Soil samples were transported to the Loxahatchee River Environmental Control District's laboratory. Pore water was vacuum-filtered from the soil samples using Whatman 541 filter paper in a Buchner funnel. The extracted water samples were analyzed for conductivity according to the Standard Methods section 2510B (Franson 1998) using a YSI Model 33 conductivity meter. Salinity was determined from conductivity through a conversion table. Pore water samples were also analyzed for chlorides by argentometric titration method, as described in Standard Methods section 4500B (Franson 1998). Results were entered into a spreadsheet and analyzed for trends associated with vegetation and estimated long-term (30-year) salinity conditions at each site.

Soil Samping Results and Discussion

Results from the soil salinity analysis are shown in **Table G-2**. Two methods of determining salinity were used in the laboratory, one by measuring conductivity and the other by chloride analysis. Both analyses yielded similar results and trends from these soils (**Table G-2**). Chloride proved to be a more sensitive measure of differences between sites and salinity determined by chloride analysis were slightly lower than salinity determined by conductivity.

The lowest surface soil (0-1 ft. depth) chloride concentrations were found at transect 1 (20–29 mg/L), the site least impacted by tidal salinity intrusion (**Figure G–2**). Progressively higher chloride concentrations were detected in surface soils from transect 2 (49–95 mg/L), transect 3 (67–130 mg/L), and transect 4 (2000–3000 mg/L). At transect 4, chloride concentrations also varied within the vertical soil profile near the floodplain/upland ecotone and the river bank (**Figure G–3**).

Soil salinity concentrations did not reveal a well-defined gradient along the River, as was found with the chloride data. Although the plant community at transect 3 contained both freshwater and saltwater-tolerant species, soil salinity concentrations were comparable to those at unimpacted sites (transects 1 and 2). However, chloride concentrations at transect 3 (67-130 ml/L), where some red mangrove were present, were higher than in areas inhabited by strictly freshwater vegetation.

These data indicate that soil chloride concentration, rather than salinity, may be a better parameter to use to characterize the salinity gradient along upstream portions of the NW Fork. A distinct chloride gradient was detected, associated with proximity to the Jupiter Inlet. However, elevated salinity levels were found only at transect 4 sampling sites, an area that has been strongly impacted by elevated salinity for many decades.

Results from this study indicate that “background” salinity levels are very low (0.1-0.2 ppt) in unimpacted areas. This study also suggests that salinity is not retained in the soils for long periods of time. At transect 3, an area that is affected by elevated salinity conditions during droughts (e.g. 1999-2001), salinity was comparable to the pristine transects 1 and 2.

It is important to understand that the scope of this sampling effort was narrow and interpretation or application the results are limited. This preliminary study does not address potential changes in soil salinity attributed to seasonal hydrological patterns (dry season vs. wet season), droughts, duration of exposure to a salinity concentration, soil salinity memory (ability to retain sodium or chloride), spatial distribution along the River corridor, and vertical distribution within the soil profile (which affects shallow or deeply rooted plants differently). The findings from this study can be also be useful in designing a long-term soil salinity sampling effort.

Table G-2. Soil Salinity from Transects, Calculated from Conductivity (Cond., ppt*) and Chloride (Cl, ppt) Analysis

Collection Date	Transect	Plot	Conductivity (Mho/cm)	Temp. (°C)	Salinity (Cond., ppt)	Chloride (mg/L)	Salinity (Cl, ppt)
1/22/02	1	River bed (grab)				29	0.05
1/23/02	1	River bottom				20	0.03
1/23/02	2	0-3 m	730	24	0.2	95	0.2
1/23/02	2	3-13 m	630	23	0.2	49	0.1
1/23/02	2	33-43 m	680	23	0.2	69	0.1
1/24/02	3	0-10 m	710	24	0.2	110	0.2
1/24/02	3	30-40 m	870	23	0.5	130	0.2
1/24/02	3	64-74 m				67	0.1
1/24/02	3	floodplain/upland ecotone	680	23	0.2	81	0.1
1/24/02	4	0-10 m (0'-1')	9900	24	5.5	3000	4.9
1/24/02	4	0-10 m (1'-2')	7900	25	4	2500	4.2
1/24/02	4	0-10 m (2'-3')	6000	23	4.5	2000	3.3
1/24/02	4	45-55 m (0'-1')	6600	23	4.5	2000	3.4
1/24/02	4	45-55 m (1'-2')	6600	23	4.5	2100	3.5
1/24/02	4	45-55 m (2'-3')	5500	23	3.0	1900	3.2
1/24/02	4	95-105 m (0'-1')	8100	23	6.5	3000	4.9
1/24/02	4	95-105 m (1'-2')	7700	23	4.2	2400	4.0
1/24/02	4	95-105 m (2'-3')	9300	23	5.2	2700	4.5
1/24/02	4	155-165 m (0'-1')	10400	23	5.9	2800	4.7
1/24/02	4	155-165 m (1'-2')	8200	23	6.5	3000	4.9
1/24/02	4	155-165 m (2'-3')	9900	23	7.7	3500	5.7

*ppt = parts per thousand

Figure G–2. Range of Chloride Concentrations measured in Soils along the NW Fork of the Loxahatchee River

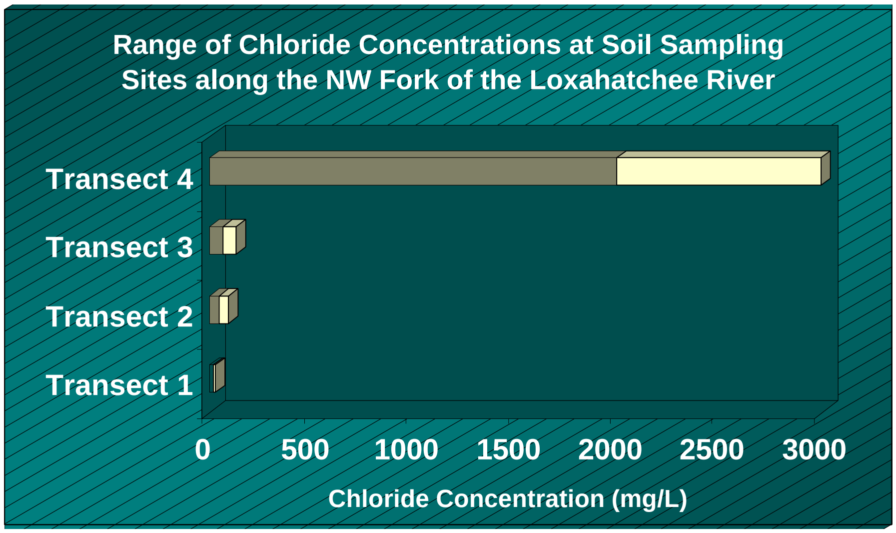
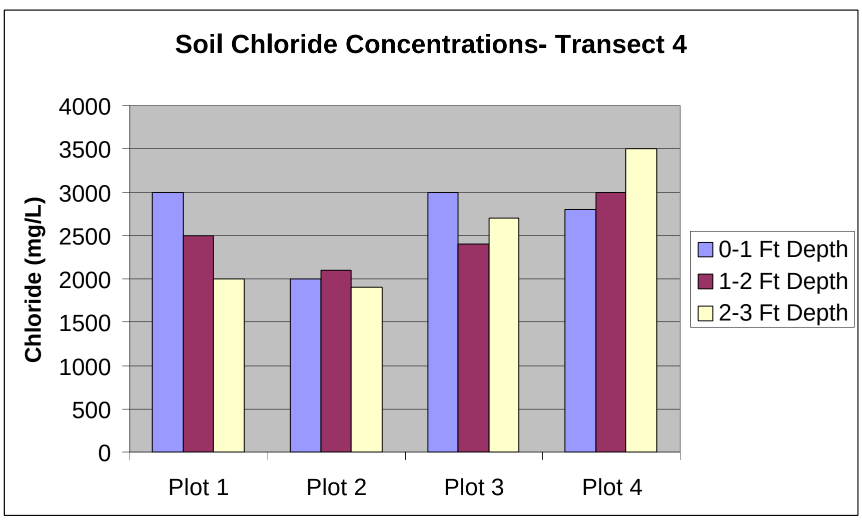


Figure G–3. Chloride Concentrations in the Vertical Soil Profile at Transect 4.



CONCLUSIONS

The results from our soil survey, which are of limited scope, suggest soil salinity is not a good predictor of long-term salinity conditions and was not useful in defining salinity conditions that lead to a decline in freshwater vegetation associated with salinity exposure. Chloride concentration, however, was more closely associated with distance from the Jupiter Inlet. More frequent and more extensive long-term soil salinity monitoring may provide data needed to determine spatial and temporal changes, and the extent of salinity concentrations that may affect the ecological community at a site.

REFERENCES

Franson, Mary Ann H. (ed.). 1998. Standard Methods for the Examination of Water and Waste Water, 20th edition. American Public Health Association, 1015 NW 15th Street, Washington DC 20005-2605.